(a)

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-055140
(43)Date of publication of application : 26.02.1999

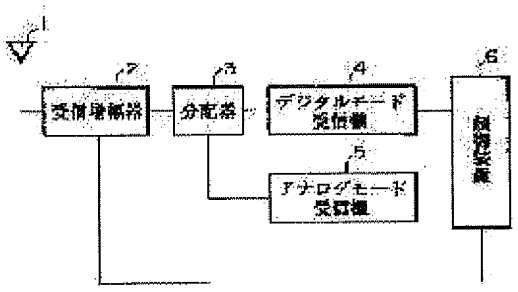
(51)Int.Cl. H04B 1/26
H04B 7/26
H04Q 7/38

(21)Application number : 09-203610
(22)Date of filing : 29.07.1997

(71)Applicant : SAITAMA NIPPON DENKI KK
(72)Inventor : KAWASHIMA ETSUO

(54) RECEIVER

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a receiver that realizes low system power consumption by receiving a demodulation signal and electric field information from a digital mode receiver and an analog mode receiver and giving a control voltage which corresponds to the operating state of the digital mode receiver and the analog mode receiver.
SOLUTION: A reception wave is received through an antenna 1 and distributed to a digital mode receiver 4 and an analog mode receiver 5 respectively, via a reception amplifier 2 and a distributer 3. The received modulation wave is respectively demodulated corresponding to digital/analog signals, and the digital mode receiver 4 and the analog mode receiver receiver 5 give a reception electric field strength signal to a controller 6. The controller 6 gives a prescribed control voltage to the reception amplifier 2, based on a production rate of the reception electric field strength signal and the demodulated signal to select the electric characteristic of the reception amplifier 2. As a result, a system operation with reduced power consumption of the reception amplifier 2 is realize without having the reception quality deteriorated.



LEGAL STATUS

[Date of request for examination]	29.07.1997
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	3110354
[Date of registration]	14.09.2000
[Number of appeal against examiner's decision	

of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right] 14.09.2003

CLAIMS

[Claim(s)]
[Claim 1] The head amplifier which carries out power amplification of the high frequency signal received through the antenna to the level corresponding to control voltage, The distributor which distributes the high frequency signal by which power amplification was carried out with this head amplifier to each of a digital mode receiver and an analog mode receiver, The recovery signal and electric-field information from said digital mode receiver and an analog mode receiver are considered as an input. The receiving set characterized by having the control unit which inputs the control voltage corresponding to the employment condition of these digital mode receivers and an analog mode receiver into said head amplifier.
[Claim 2] The receiving set according to claim 1 characterized by said head amplifier consisting of the 1st transistor which amplifies the high frequency signal received through said antenna, and the 2nd transistor and 3rd transistor which carry out linear amplification of the output signal of this 1st transistor according to the control voltage from said control device.
[Claim 3] The receiving set according to claim 1 characterized by controlling said head amplifier to be able to stop power consumption the optimal, without degrading receiving quality with the control voltage from said control unit.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the receiving set used for the dual mode reception in mobile communication system, such as a land mobile radiotelephone.
[0002]
[Description of the Prior Art] There are some which are shown in drawing 7 as a conventional receiving set. The head amplifier which will carry out power amplification of the RF signal with which 1 went via the antenna and 2 went via the antenna 1 in this drawing if this is explained, With a distributor 3, while was distributed and the distributor with which 3 allots the RF signal output of a head amplifier 2 by power, and 7 input a RF signal. The power detecting element which outputs a change signal, and 8 consider the RF signal of another side from a distributor 3, and the change signal from the power detecting element 7 as an input. The received-power control switch which chooses a flow location, and 9 consider the RF signal from the received-power control switch 8, and the ON / off signal from ON / off controller 12 as an input. The head amplifier which carries out power amplification, and 10 consider the RF signal from a head amplifier 9 and the received-power control switch 8 as an input. The received-power control switch which chooses a flow location with the change signal from the power detecting element 7, and 11 are receivers which receive the RF signal from the received-power control switch 10.
[0003] Next, actuation is explained. First, in a condition with many communication lines, or a traffic condition which is strong, the power level on reception detected by the power detecting element 7 becomes larger than default value, and the received-power control switch 8 and the received-power control switch 10 choose the head amplifier 9 side of initial setting with the change signal from the power detecting element 7. Therefore, the high frequency signal received with the antenna 1 is inputted into a receiver 11 respectively via a head amplifier 2, a distributor 3, the received-power control switch 8, a head amplifier 9, and the received-power control switch 10.
[0004] On the other hand, the power level on reception detected by the power detecting element 7 becomes smaller than default value, the received-power control switch 8 and the received-power control switch 10 are changed by the change signal from the power detecting element 7 in a traffic condition which there are few communication lines and is weak, and a high frequency signal is inputted into a receiver 11 via a head amplifier 2, a distributor 3, the received-power control switch 8, and the received-power control switch 10. ON / off controller 12 intercepts the power source of a head amplifier 9 with the change signal outputted to coincidence from the power detecting element 7. Thus, ON / off controller 12 intercepts the power source of a head amplifier 9 with the change signal outputted from the power detecting element 7 with the difference at the time of a weak-electric-current community like [in the case of passing through the time of a heavy current community like / in the case of passing through the land region sky /, and the marine region sky], the unnecessary power consumption of a head amplifier system is reduced, and such a technique is indicated by JP,8-37482,A.
[0005] moreover, in what constituted the conventional TIA/EIA/IS-54-B analog-to-digital dual mode receiver using one head amplifier Regardless of the amount of traffic of the number of

communication lines, and the strength of received electric field, the electrical orders (a noise figure NF, intermodulation distortion IM, etc.) of a head amplifier are decided according to the digital mode receiver with a high receiving property. This sake, The electrical order beyond the need will be demonstrated in the environment of the traffic of only an analog mode receiver, and superfluous power consumption was caused.
[0006]
[Problem(s) to be Solved by the Invention] The conventional receiving set is constituted as mentioned above. By decision of only a received electric-field level value Choose, and since he is trying to intercept the power source of the head amplifier 9 which has not chosen [which connects a head amplifier 9 / or or] whether a detour is carried out, in the above dual mode receivers When detecting only receiving level and changing a head amplifier 9, it cannot judge correctly whether there to be and whether much traffic (the number of communication lines) is few. It chose [which optimal low-power operation cannot be performed and connects a head amplifier 9 / or or] whether a detour would be carried out, and in order to intercept the power source of the head amplifier 9 which is not chosen, circuitry became complicated and the technical problem that the miniaturization of a system and a low price were barred occurred.
[0007] Moreover, since the electrical characteristics of a head amplifier 9 are decided according to the high digital mode of necessary C/N (carrier pair noise ratio) and a traffic condition (the number of communication lines) cannot be detected, In a dual mode receiver, when a traffic situation is analog mode reception (condition that all the users are communicating at the analog migration terminal) The noise figure NF only whose differences of necessary C/N in digital mode and necessary C/N in analog mode are the electrical characteristics of a head amplifier becomes superfluous, and also About the intermodulation distortion IM which is one of the specification of a head amplifier, when it was in a traffic condition which is low, the technical problem that it became superfluous occurred. Here, when the consumed electric current of a head amplifier has a noise figure NF, and intermodulation distortion IM and a correlation and the property was determined for digital modes, it had the technical problem that the consumed electric current of a system was wasted, in other traffic conditions.
[0008] This invention is [0009] aiming at obtaining the receiving set which can realize low-power-ization of a system by solving the above technical problems and changing the electrical characteristics of a head amplifier according to traffic conditions, such as the receive mode of digital one/analog, the number of communication lines, and a received electric-field value.
[Means for Solving the Problem] The receiving set concerning invention of claim 1 for said purpose achievement The head amplifier which carries out power amplification of the high frequency signal received through the antenna to the level corresponding to control voltage, The distributor which distributes the high frequency signal by which power amplification was carried out with this head amplifier to each of a digital mode receiver and an analog mode receiver is formed.

TECHNICAL FIELD

[Field of the Invention] This invention relates to the receiving set used for the dual mode reception in mobile communication system, such as a land mobile radiotelephone.

[Translation done.]

PRIOR ART

[Description of the Prior Art] There are some which are shown in drawing 7 as a conventional receiving set. The head amplifier which will carry out power amplification of the RF signal with which 1 went via the antenna and 2 went via the antenna 1 in this drawing if this is explained, With a distributor 3, while was distributed and the distributor with which 3 allots the RF signal output of a head amplifier 2 by power, and 7 input a RF signal. The power detecting element which outputs a change signal, and 8 consider the RF signal of another side from a distributor 3, and the change signal from the power detecting element 7 as an input. The received-power control switch which chooses a flow location, and 9 consider the RF signal from the received-power control switch 8, and the ON / off signal from ON / off controller 12 as an input. The head amplifier which carries out power amplification, and 10 consider the RF signal from a head amplifier 9 and the received-power control switch 8 as an input. The received-power control switch which chooses a flow location with the change signal from the power detecting element 7, and 11 are receivers which receive the RF signal from the received-power control switch 10.
[0003] Next, actuation is explained. First, in a condition with many communication lines, or a traffic condition which is strong, the power level on reception detected by the power detecting element 7 becomes larger than default value, and the received-power control switch 8 and the received-power control switch 10 choose the head amplifier 9 side of initial setting with the change signal from the power detecting element 7. Therefore, the high frequency signal received with the antenna 1 is inputted into a receiver 11 respectively via a head amplifier 2, a distributor 3, the received-power control switch 8, a head amplifier 9, and the received-power control switch 10.
[0004] On the other hand, the power level on reception detected by the power detecting element 7 becomes smaller than default value, the received-power control switch 8 and the received-power control switch 10 are changed by the change signal from the power detecting element 7 in a traffic condition which there are few communication lines and is weak, and a high frequency signal is inputted into a receiver 11 via a head amplifier 2, a distributor 3, the received-power control switch 8, and the received-power control switch 10. ON / off controller 12 intercepts the power source of a head amplifier 9 with the change signal outputted to coincidence from the power detecting element 7. Thus, ON / off controller 12 intercepts the power source of a head amplifier 9 with the change signal outputted from the power detecting element 7 with the difference at the time of a weak-electric-current community like [in the case of passing through the time of a heavy current community like / in the case of passing through the land region sky /, and the marine region sky], the unnecessary power consumption of a head amplifier system is reduced, and such a technique is indicated by JP,8-37482,A.
[0005] moreover, in what constituted the conventional TIA/EIA/IS-54-B analog-to-digital dual mode receiver using one head amplifier Regardless of the amount of traffic of the number of communication lines, and the strength of received electric field, the electrical orders (a noise figure NF, intermodulation distortion IM, etc.) of a head amplifier are decided according to the digital mode receiver with a high receiving property. This sake, The electrical order beyond the need will be demonstrated in the environment of the traffic of only an analog mode receiver, and superfluous power consumption was caused.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] As mentioned above, according to this invention, in the former, the effectiveness that systems operation which stopped the power consumption of a head amplifier low can be realized by changing the noise figure and intermodulation distortion which are the electrical characteristics of a head amplifier, and changing the electrical characteristics of a head amplifier in accordance with the high digital mode of C/N with the control voltage corresponding to a traffic condition (the receive mode, received electric field, and the number of receiving carriers) for what needed to determine the electrical characteristics of a head amplifier, without degrading receiving quality is acquired. Moreover, since it has neither the received-power control switch which chooses [which connects a head amplifier / or or] like before whether a detour is carried out, nor the ON / off controller which intercepts the power source of a head amplifier which has not been chosen, circuitry becomes easy and the effectiveness that a miniaturization and low price of a system are realizable is acquired.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] The conventional receiving set is constituted as mentioned above. By decision of only a received electric-field level value Choose, and since he is trying to intercept the power source of the head amplifier 9 which has not chosen [which connects a head amplifier 9 / or or] whether a detour is carried out, in the above dual mode receivers When detecting only receiving level and changing a head amplifier 9, it cannot judge correctly whether there to be and whether much traffic (the number of communication lines) is few. It chose [which optimal low-power operation cannot be performed and connects a head amplifier 9 / or or] whether a detour would be carried out, and in order to intercept the power source of the head amplifier 9 which is not chosen, circuitry became complicated and the technical problem that the miniaturization of a system and a low price were barred occurred.
[0007] Moreover, since the electrical characteristics of a head amplifier 9 are decided according to the high digital mode of necessary C/N (carrier pair noise ratio) and a traffic condition (the number of communication lines) cannot be detected, In a dual mode receiver, when a traffic situation is analog mode reception (condition that all the users are communicating at the analog migration terminal) The noise figure NF only whose differences of necessary C/N in digital mode and necessary C/N in analog mode are the electrical characteristics of a head amplifier becomes superfluous, and also About the intermodulation distortion IM which is one of the specification of a head amplifier, when it was in a traffic condition which is low, the technical problem that it became superfluous occurred. Here, when the consumed electric current of a head amplifier has a noise figure NF, and intermodulation distortion IM and a correlation and the property was determined for digital modes, it had the technical problem that the consumed electric current of a system was wasted, in other traffic conditions.
[0008] This invention aims at obtaining the receiving set which can realize low-power-ization of a system by solving the above technical problems and changing the electrical characteristics of a head amplifier according to traffic conditions, such as the receive mode of digital one/analog, the number of communication lines, and a received electric-field value.

[Translation done.]

MEANS

[Means for Solving the Problem] The receiving set concerning invention of claim 1 for said purpose achievement The head amplifier which carries out power amplification of the high frequency signal received through the antenna to the level corresponding to control voltage, The distributor which distributes the high frequency signal by which power amplification was carried out with this head amplifier to each of a digital mode receiver and an analog mode receiver is formed. It is made to make said head amplifier input the control voltage corresponding to the employment condition of these digital mode receivers and an analog mode receiver into a control device by considering the recovery signal and electric-field information from said digital mode receiver and an analog mode receiver as an input.
[0010] Moreover, the receiving set concerning invention of claim 2 consists of the 1st transistor which amplifies the high frequency signal which received said head amplifier through said antenna, and the 2nd transistor and 3rd transistor which carry out linear amplification of the output signal of this 1st transistor according to the control voltage from said control device.
[0011] Moreover, the receiving set concerning invention of claim 3 controls said head amplifier to stop power consumption the optimal with the control voltage from said control unit.
[0012]
[Embodiment of the Invention] Hereafter, one gestalt of implementation of this invention is explained about drawing. Drawing 1 is the block diagram showing the receiving set of this invention, and is set to drawing. 1 An antenna, 2 considers as an input the RF signal and control voltage which went via this antenna 1. The head amplifier which performs power amplification corresponding to control voltage, and 3 consider the RF signal by which power amplification was carried out as an input. The distributor which allots this to the digital mode receiver 4 and the analog mode receiver 5 for 2 minutes, 6 is a control device which considers the recovery signal and electric-field information on the digital mode receiver 4 and the analog mode receiver 5 as an input, and functions as this outputting the control power corresponding to the employment condition of the digital mode receiver 4 and the analog mode receiver 5.
[0013] Next, the case where this invention is applied to digital one / analog mobile communication system which has adopted TIA/EIA/IS-54-B is explained. Here, the employment approach of this migration communication system uses an analog mode receiver or a digital mode receiver as an analog mode receiver and a message channel as a control channel, and chooses it according to the condition of a mobile terminal. That is, when the dual mode migration terminal is being used, digital mode is chosen as a message channel and, in the case of an analog mode dedicated terminal, a message channel is a system using analog mode. Considering the reception convention which is one of the wireless specifications of this system, BER=3x10-2, -110dBm of receiving input levels, the MLSE recovery, and the sensibility convention of an analog mode receiver are decided to be 12dBSINAD(s), -116dBm of receiving input levels, and FM recovery for the sensibility convention of a digital mode receiver.
[0014] Moreover, the necessary reception C/N in a digital mode receiver is Eb/N0. And it is set to 11dB from B (band of a filter), and T (transmission speed) (the digital strange recovery technique for Triceps Publication and mobile communication, P116, drawing 13). On the other hand, a SURESHIERUDO level (SANPO PUBLICATIONS, INC., intelligible FM technique, P64)

value is set to 9dB by 12dBSINAD(s) of an analog mode receiver. About 1/is set to the SURESHIERUDO level of the feeble power of 5 by considering as the high sensitivity receiver circuit using FM negative feedback here. The value is 2dB (SANPO PUBLICATIONS, INC., intelligible FM technique, P143). Therefore, the noise figures NF for which the receiver in digital mode / analog mode is asked are 9 [dB] and 14 [dB], respectively. In such a system configuration, the value of the noise figure NF of a head amplifier becomes dominant, and the noise figure NF in an antenna edge is reflected in receiving sensibility as it is. On the other hand, input electric-field level is UP/DOWN at a mobile terminal and base transceiver station side. Transmitted power control is performed so that LINK may be kept constant. However, it is UP/DOWN when exceeding the dynamic range (28dB) of transmitted power control. LINK collapses and it becomes the situation of high electric field or a weak-electric-current community.

[0015] Then, as shown in drawing 2 and drawing 3 , it consists of three steps of amplifier (transistor) amplifier, and a head amplifier 2 performs linear amplification which is class A amplification with the 1st transistor 13 which inputs the high frequency signal from an antenna, the 2nd transistor 14, and the 3rd transistor 15. In this head amplifier 2, as for the 2nd and 3rd transistor 14 and 15, the consumed electric current is changed by control voltage, respectively. Gain is not changed although a noise figure NF and intermodulation distortion IM are changed by changing the consumed electric current. The relation between the control voltage (consumed electric current) and NF at this time, and IM ratio is shown in drawing 4 and drawing 5 .

[0016] Generally, in the 1st transistor (first rank amplifier) 13, the object for low noise magnification, the 2nd transistor 14, and the 3rd transistor (tail end amplifier) 15 use the object for high power magnification. Although the consumed electric current of the 2nd and 3rd transistors 14 and 15 is controlled by control voltage, as for the consumed electric current, a noise figure NF and intermodulation distortion IM are set to 610mA by mode ** by best. Next, since mode ** makes a noise figure NF and intermodulation distortion IM the need minimum value, there is little consumed electric current as 360mA.

DESCRIPTION OF DRAWINGS

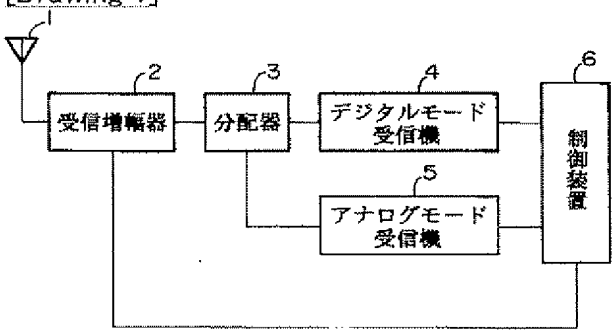
[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the receiving set by one gestalt of implementation of this invention.
[Drawing 2] It is the block diagram showing the internal configuration of the head amplifier in drawing 1 .
[Drawing 3] It is the explanatory view showing the current value passed to each transistor for every mode in drawing 2 .
[Drawing 4] It is the explanatory view showing the electrical characteristics of the head amplifier in drawing 1 .
[Drawing 5] It is the graph which shows the electrical characteristics of the head amplifier in drawing 1 .
[Drawing 6] It is the explanatory view showing the relation between the traffic and the synthetic power by this invention, and operation mode.
[Drawing 7] It is the block diagram showing the conventional receiving set.
[Description of Notations]
1 Antenna
2 Head Amplifier
3 Distributor
4 Digital Mode Receiver
5 Analog Mode Receiver
6 Control Unit
13 1st Transistor
14 2nd Transistor
15 3rd Transistor

* NOTICES *

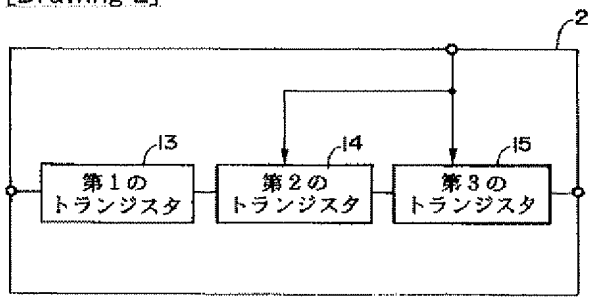
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]



[Drawing 2]



[Drawing 3]

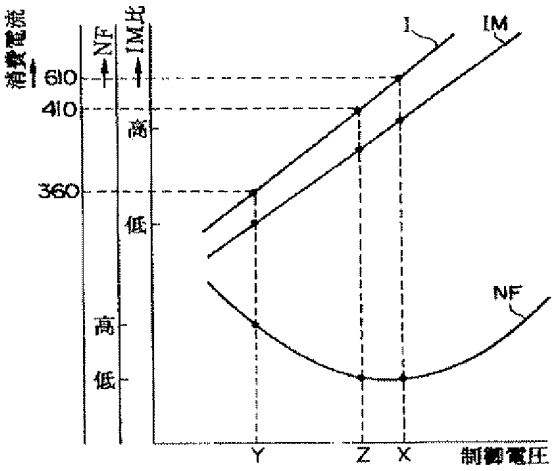
モード	第1のトランジスタ電流	第2のトランジスタ電流	第3のトランジスタ電流
①	10mA	100mA	500mA
②	10mA	50mA	300mA
③	10mA	100mA	300mA

[Drawing 4]

モード	制御電圧	消費電流	NF	IM
①	X	610mA	A	イ
②	Y	360mA	B	ロ
③	Z	410mA	A	ハ

A＜B
ロ＜ハ＜イ

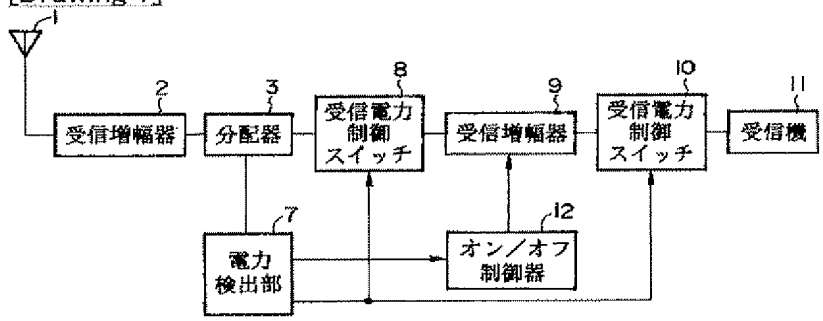
[Drawing 5]



[Drawing 6]

波の数	合成電力	モード
n以上	m[dBμV]以上	①
n以上	m[dBμV]以下	③
n以下	m[dBμV]以上	②
n以下	m[dBμV]以下	③

[Drawing 7]



[Translation done.]

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報（Ａ）**　(11)特許出願公開番号

特開平11－55140

(43)公開日　平成11年(1999)２月26日

(51)Int.Cl.[6]	識別記号	ＦＩ	
Ｈ０４Ｂ　1/26		Ｈ０４Ｂ　1/26	Ｅ
7/26		7/26	Ｘ
Ｈ０４Ｑ　7/38			１０９Ｇ
			１０９Ｈ

審査請求　有　　請求項の数３　ＯＬ　（全６頁）

(21)出願番号　特願平9－203610

(22)出願日　平成９年(1997)７月29日

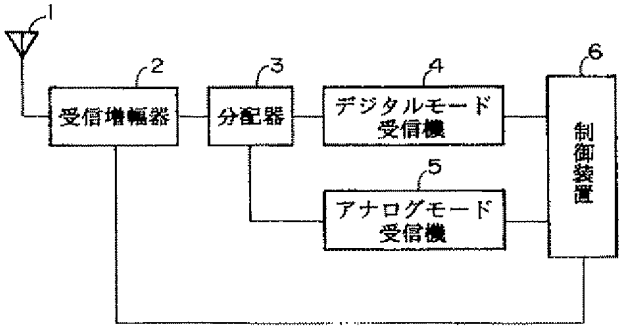
(71)出願人　390010179
埼玉日本電気株式会社
埼玉県児玉郡神川町大字元原字豊原300番18

(72)発明者　川島　悦男
埼玉県児玉郡神川町大字元原字豊原300番18　埼玉日本電気株式会社内

(74)代理人　弁理士　志賀　正武

(54)【発明の名称】　受信装置

(57)【要約】
【課題】　受信増幅器の電気的特性を切り替えることにより、システムの低消費電力化を実現可能にする。
【解決手段】　アンテナ１を通して受信した高周波信号を、制御電圧に対応したレベルに電力増幅する受信増幅器２を有し、制御装置６に、デジタルモード受信機４およびアナログモード受信機５からの復調信号および電界情報を入力として、これらのデジタルモード受信機４およびアナログモード受信機５の運用状態に対応した制御電力を受信増幅器２に入力させる。



1

【特許請求の範囲】

【請求項１】　アンテナを通して受信した高周波信号を、制御電圧に対応したレベルに電力増幅する受信増幅器と、

該受信増幅器にて電力増幅された高周波信号をデジタルモード受信機およびアナログモード受信機のそれぞれに分配する分配器と、

前記デジタルモード受信機およびアナログモード受信機からの復調信号および電界情報を入力として、これらのデジタルモード受信機およびアナログモード受信機の運用状態に対応した制御電圧を前記受信増幅器に入力する制御装置とを備えたことを特徴とする受信装置。

【請求項２】　前記受信増幅器が、前記アンテナを通して受信した高周波信号を増幅する第１のトランジスタと、該第１のトランジスタの出力信号を前記制御装置からの制御電圧に応じて直線増幅する第２のトランジスタおよび第３のトランジスタとからなることを特徴とする請求項１に記載の受信装置。

【請求項３】　前記受信増幅器が、前記制御装置からの制御電圧によって受信品質を劣化させずに消費電力を最適に抑えられるように制御されることを特徴とする請求項１に記載の受信装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】この発明は、自動車電話などの移動体通信システムにおけるデュアルモード受信に使用される受信装置に関するものである。

【０００２】

【従来の技術】従来の受信装置として、例えば図７に示すものがある。これについて説明すると、同図において、１はアンテナ、２はアンテナ１を経由した高周波信号を電力増幅する受信増幅器、３は受信増幅器２の高周波信号出力を電力分配する分配器、７は分配器３で分配された一方の高周波信号を入力し、切替信号を出力する電力検出部、８は分配器３からの他方の高周波信号と電力検出部７からの切替信号とを入力として、導通位置を選択する受信電力制御スイッチ、９は受信電力制御スイッチ８からの高周波信号およびオン／オフ制御器１２からのオン／オフ信号を入力として、電力増幅をする受信増幅器、１０は受信増幅器９および受信電力制御スイッチ８からの高周波信号を入力として、電力検出部７からの切替信号により導通位置を選択する受信電力制御スイッチ、１１は受信電力制御スイッチ１０からの高周波信号を受信する受信機である。

【０００３】次に動作を説明する。まず、通信回線数が多い状態あるいは受信電界が強いようなトラフィック状態においては、電力検出部７で検出される受信電力レベルが規定値より大きくなり、電力検出部７からの切替信号により受信電力制御スイッチ８および受信電力制御スイッチ１０は初期設定の受信増幅器９側を選択する。従

2

って、アンテナ１で受信された高周波信号は受信増幅器２，分配器３，受信電力制御スイッチ８，受信増幅器９および受信電力制御スイッチ１０をそれぞれ経由して受信機１１に入力される。

【０００４】一方、通信回線数が少なく、かつ受信電界が弱いようなトラフィック状態においては、電力検出部７で検出される受信電力レベルが規定値より小さくなり、電力検出部７からの切替信号により受信電力制御スイッチ８および受信電力制御スイッチ１０が切り替えられて、高周波信号は受信増幅器２，分配器３，受信電力制御スイッチ８および受信電力制御スイッチ１０を経由して受信機１１に入力される。同時に、電力検出部７から出力される切替信号により、オン／オフ制御器１２は受信増幅器９の電源を遮断する。このように、陸上域上空を通過する場合のような強電界時と海上域上空を通過する場合のような弱電界時の相違に伴い、電力検出部７から出力される切替信号によりオン／オフ制御器１２は受信増幅器９の電源を遮断し、受信増幅器システムの不要な消費電力を低減しており、このような技術が、例えば特開平８－３７４８２号公報に開示されている。

【０００５】また、従来のＴＩＡ／ＥＩＡ／ＩＳ－５４－Ｂアナログ／デジタルデュアルモード受信機を１つの受信増幅器を用いて構成したものでは、通信回線数のトラフィック量および受信電界の強弱に関係なく、受信特性の高いデジタルモード受信機に合わせて、受信増幅器の電気的性能（雑音指数ＮＦおよび相互変調歪ＩＭ等）を決めており、このため、アナログモード受信機のみのトラフィックの環境においては必要以上の電気的性能を発揮することとなり、過剰な消費電力を招いていた。

【０００６】

【発明が解決しようとする課題】従来の受信装置は以上のように構成されており、受信電界レベル値のみの判断で、受信増幅器９を接続するか迂回するかを選択し、選択していない受信増幅器９の電源を遮断するようにしているため、前記のようなデュアルモード受信機では、受信レベルのみ検出して受信増幅器９を切り替える場合、トラフィック（通信回線数）が多いのか少ないのかを正確に判断できず、最適な低消費電力運転ができず、また、受信増幅器９を接続するか迂回するかを選択し、選択しない受信増幅器９の電源を遮断するため、回路構成が複雑となり、システムの小型化，低価格を妨げるという課題があった。

【０００７】また、所要のＣ／Ｎ（キャリア対ノイズ比）の高いデジタルモードに合わせて受信増幅器９の電気的特性が決められ、また、トラフィック状態（通信回線数）を検出できないため、デュアルモード受信機においては、トラフィック状況がアナログモード受信の場合（ユーザーの全てがアナログ移動端末で通信している状態）には、デジタルモードの所要のＣ／Ｎとアナログモードの所要のＣ／Ｎの差だけ受信増幅器の電気的特性で

ある雑音指数ＮＦが過剰になるほか、受信増幅器の規格の一つである相互変調歪ＩＭに関しては、受信電界レベルが低いようなトラフィック状態のとき、過剰になるという課題があった。ここで、受信増幅器の消費電流は、雑音指数ＮＦ，相互変調歪ＩＭと相関関係があり、デジタルモード用に特性を決定すると、他のトラフィック状態においては、システムの消費電流を浪費するという課題があった。

【０００８】この発明は、前記のような課題を解決するものであり、デジタル／アナログの受信モード、通信回線数および受信電界値等のトラフィック状態に応じて、受信増幅器の電気的特性を切り替えることにより、システムの低消費電力化を実現できる受信装置を得ることを目的とする

【０００９】

【課題を解決するための手段】前記目的達成のため、請求項１の発明にかかる受信装置は、アンテナを通して受信した高周波信号を、制御電圧に対応したレベルに電力増幅する受信増幅器と、該受信増幅器にて電力増幅された高周波信号をデジタルモード受信機およびアナログモード受信機のそれぞれに分配する分配器とを設けて、制御装置に、前記デジタルモード受信機およびアナログモード受信機からの復調信号および電界情報を入力として、これらのデジタルモード受信機およびアナログモード受信機の運用状態に対応した制御電圧を前記受信増幅器に入力させるようにしたものである。

【００１０】また、請求項２の発明にかかる受信装置は、前記受信増幅器を、前記アンテナを通して受信した高周波信号を増幅する第１のトランジスタと、該第１のトランジスタの出力信号を前記制御装置からの制御電圧に応じて直線増幅する第２のトランジスタおよび第３のトランジスタとから構成したものである。

【００１１】また、請求項３の発明にかかる受信装置は、前記受信増幅器を、前記制御装置からの制御電圧によって消費電力を最適に抑えるように制御したものである。

【００１２】

【発明の実施の形態】以下、この発明の実施の一形態を図について説明する。図１はこの発明の受信装置を示すブロック図であり、図において、１はアンテナ、２はこのアンテナ１を経由した高周波信号および制御電圧を入力とし、制御電圧に対応した電力増幅を行う受信増幅器、３は電力増幅された高周波信号を入力とし、これをデジタルモード受信機４およびアナログモード受信機５へ２分配する分配器、６はデジタルモード受信機４およびアナログモード受信機５の復調信号および電界情報を入力とする制御装置であり、これがデジタルモード受信機４およびアナログモード受信機５の運用状態に対応した制御電力を出力するように機能する。

【００１３】次に、この発明をＴＩＡ／ＥＩＡ／ＩＳ－５４－Ｂを採用しているデジタル／アナログ移動体通信システムに適用した場合について説明する。ここで、この移動通信システムの運用方法は、制御チャネルとしてはアナログモード受信機、通話チャネルとしてはアナログモード受信機もしくはデジタルモード受信機を使用し、移動体端末の状態によって選択するものである。つまり、デュアルモード移動端末を使っている場合は、通話チャネルにデジタルモードを選択し、アナログモード専用端末の場合、通話チャネルがアナログモードを使うシステムである。このシステムの無線仕様の１つである受信規定を考えると、デジタルモード受信機の感度規定は、ＢＥＲ＝３×１０-2、受信入力レベル－１１０ｄＢｍ、ＭＬＳＥ復調、アナログモード受信機の感度規定は１２ｄＢＳＩＮＡＤ、受信入力レベル－１１６ｄＢｍ、ＦＭ復調と決められている。

【００１４】また、デジタルモード受信機における所要受信Ｃ／Ｎは、Ｅｂ／Ｎ0 およびＢ（フィルタの帯域）、Ｔ（伝送速度）より１１ｄＢとなる（株式会社トリケップス出版，移動通信のためのデジタル変復調技術，Ｐ１１６，図１３）。一方、アナログモード受信機の１２ｄＢＳＩＮＡＤでスレシェールド・レベル（産報出版（株），わかりやすいＦＭ技術，Ｐ６４）値は、９ｄＢとなる。ここで、ＦＭ負帰還を用いた高感度受信機回路とすることで約１／５の微弱電力のスレシェールド・レベルとなる。その値は、２ｄＢである（産報出版（株），わかりやすいＦＭ技術，Ｐ１４３）。そのためデジタルモード／アナログモードの受信機に求められる雑音指数ＮＦは、それぞれ９［ｄＢ］と１４［ｄＢ］である。このようなシステム構成においては、アンテナ端での雑音指数ＮＦは受信増幅器の雑音指数ＮＦの値が、支配的となり、受信感度にそのまま反映される。一方、入力電界レベルは移動体端末と無線基地局側でＵＰ／ＤＯＷＮ　ＬＩＮＫを一定に保つよう、送信電力制御を行っている。しかし、送信電力制御のダイナミックレンジ（２８ｄＢ）を越えるようなときは、ＵＰ／ＤＯＷＮ ＬＩＮＫがくずれて、高電界あるいは弱電界の状況となる。

【００１５】そこで図２および図３に示すように、受信増幅器２は、例えば、３段の増幅素子（トランジスタ）アンプで構成され、アンテナからの高周波信号を入力する第１のトランジスタ１３、第２のトランジスタ１４、第３のトランジスタ１５によりＡ級増幅である直線増幅を行う。この受信増幅器２では第２，第３のトランジスタ１４，１５は制御電圧によって、それぞれ消費電流が切り替えられる。消費電流を切り替えることによって、雑音指数ＮＦや相互変調歪ＩＭが切り替えられるが、利得は変動しない。このときの、制御電圧（消費電流）とＮＦおよびＩＭ比の関係を図４および図５に示す。

【００１６】一般に、第１のトランジスタ（初段アンプ）１３は低雑音増幅用、第２のトランジスタ１４およ

び第３のトランジスタ（終段アンプ）１５は高出力増幅用を用いる。制御電圧によって第２および第３のトランジスタ１４，１５の消費電流を制御するが、モード①は雑音指数ＮＦおよび相互変調歪ＩＭが最良で消費電流は６１０ｍＡとなる。次に、モード②は雑音指数ＮＦおよび相互変調歪ＩＭを必要最小値にしているため、消費電流は３６０ｍＡと少ない。最後に、モード③はモード①に対して相互変調歪ＩＭのみ緩和しているため、消費電流は４１０ｍＡである。

【００１７】次に、図１に示す受信装置における高周波信号の流れを説明する。受信波はアンテナ１を通して受信され、受信増幅器２および分配器３を経由して、デジタルモード受信機４およびアナログモード受信機５のそれぞれに分配入力される。入力された変調波はデジタル／アナログに対応してそれぞれが復調され、制御装置６へ受信電界強度（ＲＳＳＩ）信号を送出する。制御装置６はこの受信電界強度信号と復調信号の発生率にもとづいて、所定の制御電圧を受信増幅器２へ送出し、この受信増幅器の電気的特性を切り替える。続いて、受信電界レベル、通信回線数の異なったトラフィック状態についてそれぞれ説明する。まず、第１に、初期状態（トラフィックが０→１波の場合）は制御チャネルがアナログモード受信のため、制御装置６から図４に示すような制御電圧Ｙを送出し、受信増幅器２はモード②で運転する。次に通話チャネルに切り替わりデジタルモード受信となるが、制御装置６から制御電圧Ｙを送出し続けて、モード②の運転をし続ける。また、第２に、トラフィックが増えていきデジタルモード受信が、図６に示すように、ｎ波以上且つ合成電力がｍ［ｄＢμＶ］以上のような場合には、制御装置６から図４に示すような制御電圧Ｘを送出し、受信増幅器２はモード①の運転に切り替わる。このことにより、従来技術のデジタルモードのみを考慮した受信増幅器２の電気的性能運転となる。

【００１８】さらに、第３に、デジタルモードの受信電界レベルが減り、図６に示すように、トラフィックがｎ波以上且つｍ［ｄＢμＶ］以下の場合には、制御装置６から図４に示すような制御電圧Ｚを送出し、受信増幅器２は、モード③の運転に切り替わる。次に、第４として、デジタルモードの受信波が減り、図６に示すように、トラフィックが数波だけの高電界な状態となり、合成電力としてｍ［ｄＢμＶ］以上の場合には、制御装置６から制御電圧Ｙを送出する。これにより受信増幅器２はモード②の運転に切り替わる。第５として、図６に示すように、トラフィック状態がデジタル受信波の電力も減るようｎ波以下且つｍ［ｄＢμＶ］以下の場合には、

制御装置６から制御電圧Ｙを送出し、受信増幅器２はモード②の運転のままとする。このようにしてデジタルモード受信の波（キャリア）数および合成電力値の２つのパラメータにより、３種類の制御電圧を制御装置６から受信増幅器２に送出し、トラフィックの状況に対応した最適な受信増幅器２の運転を行うことができる。

【００１９】

【発明の効果】以上のように、この発明によれば、従来において、Ｃ／Ｎの高いデジタルモードにあわせて、受信増幅器の電気的特性を決める必要があったものを、トラフィック状態（受信モード，受信電界および受信キャリア数）に対応した制御電圧によって受信増幅器の電気的特性である雑音指数および相互変調歪を切り替え、受信増幅器の電気的特性を切り替えることで、受信品質を劣化させることなく、受信増幅器の消費電力を低く抑えたシステム運用が実現できるという効果が得られる。また、従来のように、受信増幅器を接続するか迂回するかを選択する受信電力制御スイッチや、選択していない受信増幅器の電源を遮断するオン／オフ制御器を有しないため、回路構成が簡単となり、システムの小型化および低価格を実現できるという効果が得られる。

【図面の簡単な説明】

【図１】　この発明の実施の一形態による受信装置を示すブロック図である。

【図２】　図１における受信増幅器の内部構成を示すブロック図である。

【図３】　図２において各モードごとに各トランジスタに流す電流値を示す説明図である。

【図４】　図１における受信増幅器の電気的特性を示す説明図である。

【図５】　図１における受信増幅器の電気的特性を示すグラフである。

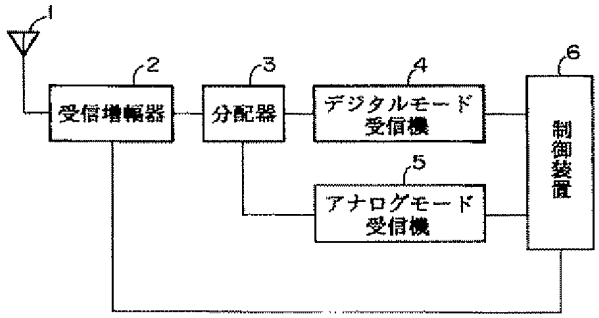
【図６】　この発明によるトラフィックおよび合成電力と運転モードとの関係を示す説明図である。

【図７】　従来の受信装置を示すブロック図である。

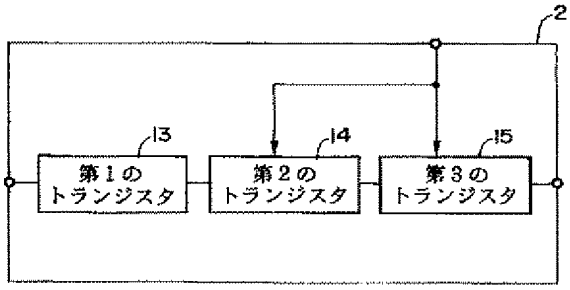
【符号の説明】

１　アンテナ
２　受信増幅器
３　分配器
４　デジタルモード受信機
５　アナログモード受信機
６　制御装置
１３　第１のトランジスタ
１４　第２のトランジスタ
１５　第３のトランジスタ

【図１】



【図２】



【図３】

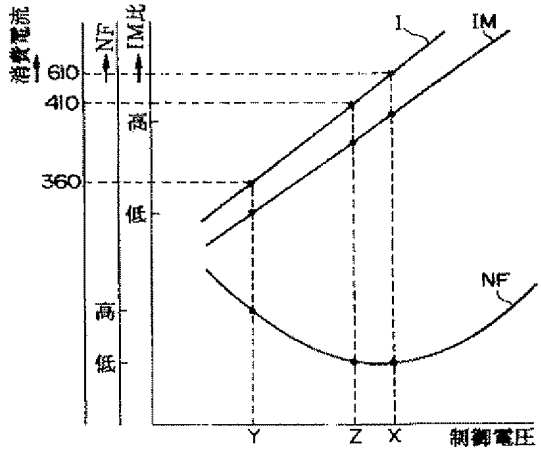
モード	第１のトランジスタ電流	第２のトランジスタ電流	第３のトランジスタ電流
①	10mA	100mA	500mA
②	10mA	50mA	300mA
③	10mA	100mA	300mA

【図４】

モード	制御電圧	消費電流	ＮＦ	ＩＭ
①	X	610mA	A	イ
②	Y	360mA	B	ロ
③	Z	410mA	A	ハ

A＜B
ロ＜ハ＜イ

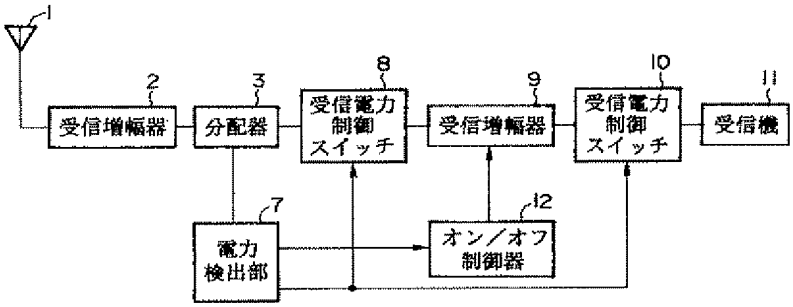
【図５】



【図６】

波の数	合成電力	モード
n以上	m[dBμV]以上	①
n以上	m[dBμV]以下	③
n以下	m[dBμV]以上	②
n以下	m[dBμV]以下	③

【図７】


1
2
受信増幅器
3
分配器
8
受信電力
制御
スイッチ
9
受信増幅器
10
受信電力
制御
スイッチ
11
受信機
7
電力
検出部
12
オン／オフ
制御器